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State of Alaska

Bill Sheffield, Governor

Annual Performance Report for

GLENNALLEN/PRINCE WILLIAM SOUND ANGLER USE AND STOCK ASSESSMENT STUDIES

by

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RESEARCH PROJECT SEGMENT

State: Alaska

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Study Title: INVENTORY AND CATALOGING

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Job Title: Glennallen/Prince William Sound Angler Use and Stock Assessment Studies

Cooperators: Fred T. Williams and Wilson D. Potterville

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ABSTRACT

Aerial chinook salmon, *Oncorhynchus tshawytscha* (Walbaum), escapements were conducted on selected index streams in the area. A record 1,770 adult chinook salmon were counted in the Gulkana River after termination of the fisheries. The average annual count from 1977 through 1983 was 1,051.

Population estimates were initiated on rainbow trout, *Salmo gairdneri*, Richardson, in Mary Lou, David, and Katherine Lakes. Minnow traps were fished a total of 2,446 hours in the three lakes and caught only four rainbow trout. Because of the low number of fish captured, no estimates were made.

During steelhead trout studies conducted in the Middle Fork of the Gulkana River, 123 spawners were observed and the total number present was estimated to be at least 200. Data on physical parameters of redds and resting/pairing areas were also collected.

Fourteen managed lakes were test-netted in 1984. Fish species captured include: Arctic grayling, *Thymallus arcticus* (Pallas); rainbow trout, *Salmo gairdneri*, Richardson; whitefish, *Prosopium cylindraceum* (Pallas) and *Coregonus pidschian* (Gmelin); burbot, *Lota lota* (Linnaeus); lake trout, *Salvelinus namaycush* (Walbaum); chinook salmon, *Oncorhynchus tshawytscha* (Walbaum); coho salmon, *Oncorhynchus kisutch* (Walbaum); and longnose suckers, *Catostomus catostomus* Forster. Ten of these lakes were netted to determine success and growth of previously stocked rainbow trout and chinook salmon. In Sculpin and Van Lakes rainbow trout length doubled within 2 months after stocking. Chinook salmon

fingerlings were stocked in Strelna Lake when they averaged approximately 55 millimeters in length. Three months later fish sampled from the lake averaged 125 millimeters in fork length.

During test-netting in Summit Lake (Tebay River drainage) conducted in 1983 and 1984, no Age III or IV rainbow trout were collected. Fish taken during test netting in both years were Age I, II, V, VI and VII.

During 1984, nine previously unmanaged lakes were surveyed. These investigations included test netting, and fish species captured included grayling, lake trout, whitefish, longnose suckers, burbot and Dolly Varden, *Salvelinus malma* (Walbaum). Five of these lakes surveyed are in the Lake Louise Road area.

Arctic grayling egg take site investigations were conducted at Moose, Tahneta and Jack Lakes. A total of 1,632 grayling were trapped at Moose Lake and 2,069,000 eggs were taken from 416 females for an average fecundity of 4,974 per fish. In 1983, the average fecundity was 4,052. In 1984, 299 of 500 grayling marked in 1983 were taken in the trap for a 60 percent return. Carbon dioxide was utilized for the first time to anesthetize the fish before stripping. There was no evidence of mortality from using carbon dioxide.

Tahneta Lake was trapped for the first time and a sample 33,990 eggs were taken from 15 females for a fecundity of 2,266. Fifteen of the female grayling trapped at Jack Lake were spawned artificially and produced 62,900 eggs for an average fecundity of 4,193 per female. This egg take was limited because adequate eggs were taken from Moose Lake.

Twenty-four roadside streams in the area were electrofished. Salmon were captured in 10 of the streams that had previously been classified as nonanadromous.

During escapement surveys of Valdez Bay spawning streams, the 1984 pink salmon, *Oncorhynchus gorbuscha* (Walbaum), counts were 24 times higher than the parent year (1982).

Three hundred four sport-caught grayling from the Gulkana River ranged in fork length from 150 to 405 millimeters and averaged 271 millimeters. The weighted average length of 1,037 grayling collected and measured from 1968 through 1983 is 283 millimeters.

Seventy-seven percent of sport-caught burbot from Moose Lake in the 1984-85 winter were Age VI and VII. In 1982, these same age fish accounted for 69 percent of the catch. The oldest fish checked was Age X.

In 1984-85, Age IX to XIV sport-caught burbot comprised 78 percent of the catch from Hudson Lake. The youngest burbot recorded from this lake was Age VI. In 1974-75, 70 percent of the catch were Age IX or older. The youngest fish recorded in the catch was also Age VI.

KEY WORDS

Arctic grayling, rainbow/steelhead trout, Copper River, Gulkana River, chinook salmon, coho salmon, burbot, Valdez Arm, pink salmon.

BACKGROUND

Recreational fishing opportunities in the Copper River drainage, upper Susitna River drainage and northeastern Prince William Sound area are provided by anadromous, indigenous and stocked fish species.

Lake-dwelling species caught by recreational anglers in the Copper River Basin are the indigenous species (burbot, lake trout, Arctic grayling and whitefish) and the introduced species (coho and chinook salmon, Arctic grayling and rainbow trout). The stream dwelling species most often taken by sport anglers are Arctic grayling, Dolly Varden, rainbow/steelhead trout, whitefish, chinook and sockeye salmon.

The total fishing effort in the upper Copper/Susitna Rivers area in 1983 was less than 1% lower than in 1977. In Prince William Sound the fishing effort in 1983 was about 2% less than in 1977. The majority of angling pressure is on waters adjacent to the highway system. In 1983 in the upper Copper River area, more than 58% of the fishing pressure was expended on the Gulkana River (including Paxson and Summit Lakes) and Lake Louise area. Both of these systems are at least partially accessible by automobile. Valdez Bay and the Eyak River, both accessible from the road system, accounted for 39% of the fishing effort in Prince William Sound in 1983.

The study area, which includes the Copper River Basin, upper Susitna River Basin, Cordova, eastern Prince William Sound and Valdez, has over 650 miles of the Alaska Highway System within its borders. A map of the study area is presented in Figure 1.

Fishing within the Cordova (Prince William Sound) area is primarily commercially oriented. Access to this area is only by boat or aircraft. Sport fishing effort in salt water is primarily for coho salmon, chinook salmon, pink salmon and halibut. Freshwater angling is directed toward coho salmon, cutthroat trout, sockeye salmon, Dolly Varden and stocked grayling. A significant increase in sport fishing effort is not anticipated until access to and within the area improves. The limited Cordova area road system (approximately 60 miles in length) affords access to several lakes and streams with grayling, cutthroat trout and coho salmon populations.

Most of the recreational angling opportunities in the Valdez area are provided by saltwater fisheries directed toward bottom fish and anadromous species, including pink, chum and coho salmon. All freshwater drainages into Valdez Arm are closed to salmon fishing with the exception of a special salmon season on the Robe River; however, Dolly Varden are taken in fair numbers.

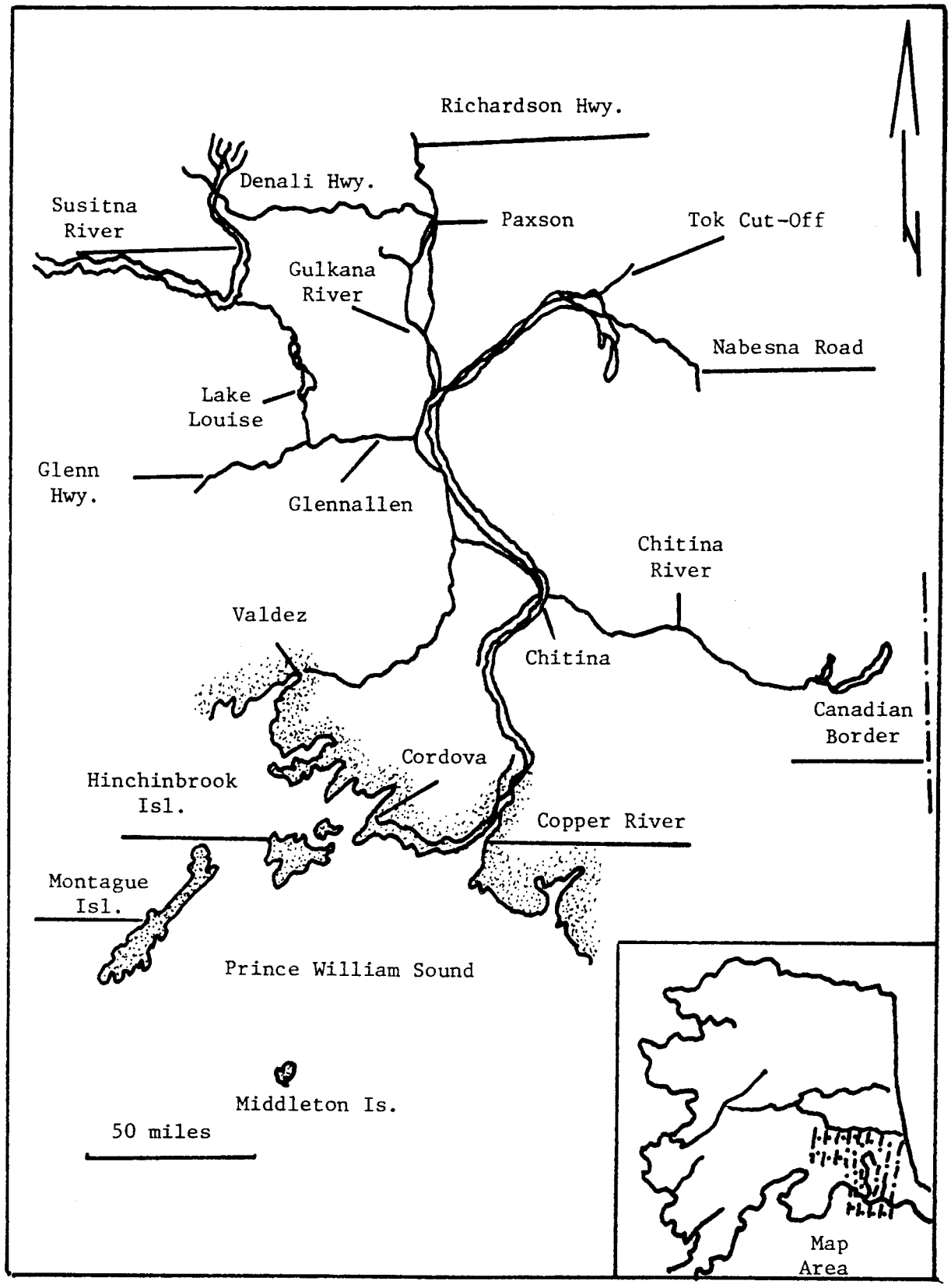

Figure 1. Map of the study area.

The present population of Valdez is estimated to be 3,750 people. There are at least three proposals to construct refineries in Valdez. If refineries are constructed, the City of Valdez estimates the population by 1990 would increase to 6,500-7,000 people. If no refineries are constructed, the population in 1990 is estimated to be some 4,450.

The growth is expected to have a detrimental effect on fish resources. Suitable land for homes and businesses is limited in the Valdez area, and already there are trailer courts, housing projects and dock facilities adjacent to or bisected by salmon spawning streams. Spawning and rearing areas for fish may be reduced, polluted and, possibly, the ground water supplies may be adversely affected. Increases in human population often result in additional harassment of spawning salmon, and increased monitoring of the fish stocks may be necessary.

Growth in the Copper River Basin area and Cordova will probably be much slower. The growth in the Basin is estimated to increase from 2,700 in 1985 to 3,100 by 1990. Cordova is expected to grow from 2,600 to 2,900 during the same period.

The land disposal program conducted by the Alaska Department of Natural Resources has made large tracts of land in the study area available for private ownership. Much of this land borders lakes and streams which support or have the potential to support fish. Retention of lands for public recreation and access is a very important facet of fisheries investigations in the area.

Presently fish stocks in the study area are in good condition and there appears to be no need for major restrictive regulations at this time. If some of the development contemplated for Valdez actually occurs, adjustments may be necessary for that area.

Activities reported in the following text are directed toward the establishment of a data base upon which management of area fish species can be conducted to maintain desirable levels of angler utilization. The species of fish discussed in this report are listed in Table 1.

RECOMMENDATIONS

1. The study of anadromous fish stocks in the upper Copper River drainage and Prince William Sound should be continued to determine run timing and magnitude with emphasis on the Gulkana River, selected index streams in the upper Copper River and streams flowing into the eastern portions of Valdez Bay.

2. Continued evaluation should be made of experimental fish stocking to determine the species and strains of fish suited for individual lakes. Lakes to be evaluated include David, South Jans, Strelna and Arizona.

Table 1. List of common mames, scientific names and abbreviations.

Common Name	Scientific Name and Author	Abbreviation
Arctic grayling	*Thymallus arcticus* (Pallas)	GR
Burbot	*Lota lota* (Linnaeus)	BB
Chinook salmon	*Oncorhynchus tshawytscha* (Walbaum)	KS
Chum salmon	*Oncorhynchus keta* (Walbaum)	CS
Coho salmon	*Oncorhynchus kisutch* (Walbaum)	SS
Cutthroat trout	*Salmo clarki* Richardson	CT
Dolly Varden	*Salvelinus malma* (Walbaum)	DV
Humpback whitefish	*Coregonus pidschiam* (Gmelin)	WF
Lake trout	*Salvelinus namaycush* (Walbaum)	LT
Longnose sucker	*Catostomus catostomus* Forster	LNS
Pacific halibut	*Hippoglossus stenolepis* Schmidt	H
Pink salmon	*Oncorhynchus gorbuscha* (Walbaum)	PS
Rainbow trout	*Salmo gairdneri* Richardson	RT
Round whitefish	*Prosopium cylindraceum* (Pallas)	WF
Slimy sculpin	*Cottus cognatus* Richardson	SSC
Sockeye salmon	*Oncorhynchus nerka* (Walbaum)	RS

3. Cataloging and inventory surveys should be continued on a limited basis to increase our knowledge of the fisheries resources in the area, provide more fishing opportunities for the angler and use as a guide in recommending lands to be reserved for public recreation.

4. Limnological and biological studies on selected managed lakes in the area should be continued to complement the studies of stocked fish survival and growth, to complete previously initiated surveys and to determine the potential for successful establishment of additional sport fisheries.

5. A grayling population study should be conducted on Moose Lake. This study would be combined with grayling trapping and egg taking operations which will be conducted at the lake by the Fisheries Rehabilitation Enhancement and Development (F.R.E.D.) Division of the Alaska Department of Fish and Game (A.D.F.& G.).

6. The investigation of potential grayling egg take sites should be continued with emphasis on Tahneta Lake. Tolsona Lake and Twin Lakes (Nabesna) should be investigated if time permits.

7. Continue age, growth and sexual maturity studies on burbot from selected lakes in the area.

8. A proposed grayling study on the Gulkana River in cooperation with the Bureau of Land Management should be initiated.

OBJECTIVES

1. To determine environmental characteristics and evaluate enhancement and management potential of East Twin, West Twin, Butte, Wrong, Little Loon and two unnamed lakes near the Lake Louise Road from July through March.

2. To continue the collection of age and length data from a minimum of 200 sport-caught grayling from the Gulkana River during July to determine trends in size and abundance.

3. To investigate and evaluate Tahneta, Scoter, Butte and Jack/Twin Lakes in May as potential grayling egg take sites.

4. To conduct salmon surveys in the Upper Copper River area and eastern Prince William Sound streams from June through October.

5. To assess the growth and survival of stocked rainbow trout in David, Katherine, Mary Lou, Hallie, Tex Smith, Crater, Buffalo, Arizona, Van, Sculpin and Strelna Lakes from June through September.

6. To collect sport-caught burbot from December through March from Moose and Hudson lakes to determine age, sex and size.

TECHNIQUES USED

Standard techniques described by Williams (1971) and outlined in the A.D.F.& G. Lake and Stream Survey Manual were used in lake and stream surveys and for collecting fish samples. Test-netting was conducted for a minimum of 16 hours, including an overnight period. In addition, fyke nets, minnow traps, weirs and rod and reel were used for fish collections. All measurements of fish lengths were from snout to fork of tail.

Winter dissolved oxygen concentrations were determined using a standard Hach field kit. Water temperatures were taken with a Heath Kit Thermo Spotter.

Salmon escapement enumerations were made from aircraft, boat and on foot.

A backpack shocker was used during electrofishing operations.

FINDINGS

Chinook Salmon Surveys

Count figures for chinook salmon in six index streams in the Upper Copper River drainage are shown in Table 2. These are actual counts made during aerial surveys by biologists from the Commercial and Sport Fish Divisions.

The total count from all six index streams was 3,604 in 1984, which was slightly lower than the highest recorded count of 3,663 in 1982.

From 1977 to 1983, fishing pressure on the Gulkana River has increased from 4,165 man-days of effort to 16,911 man-days (306%). The chinook salmon harvest has increased from 421 in 1977 to 2,224 in 1983 (428%). In 1979, the fishing effort was 17,323 man-days and the chinook salmon catch was 2,440. Even with the large increase in catch and effort, the minimum escapement after the fishery has averaged 1,051 chinook salmon from 1977 to 1983, and in 1984 a record 1,770 were counted.

Population Estimates

In 1982, three lakes in the Lake Louise area were selected for experimental stocking of rainbow trout. Zooplankton collections were made in 1981-82 in Katherine and Mary Lou Lakes (Williams and Potterville, 1982). These samples were analyzed by the F.R.E.D. Division laboratory and the consensus was that the lakes had adequate invertebrate

Table 2. Chinook salmon aerial surveys, upper Copper River tributaries, 1978-1984.*

Stream	1978	1979	1980**	1981**	1982	1983	1984
Gulkana River	1,136	1,052	696	N/C***	1,569	1,181	1,770
East Fork Chistochina River	137	765	575	120	1,260	575	579
Mendeltna Creek	52	5	3	87	70	10	26
Kaina Creek	125	279	247	191	200	166	382
Grayling Creek	92	153	66	107	124	287	279
Little Tonsina River	285	285	70	191	440	350	568
Totals	1,827	2,539	1,657	696	3,663	2,569	3,604

* The figures are actual counts and not estimates. These data are considered minimum escapement figures.

** Counting conditions in 1980 and 1981 were very poor due to high, muddy water during most of the season. Poor water and weather conditions made a count of the Gulkana River impossible in 1981.

*** No counts made.

populations to support a salmonid population. No prestocking invertebrate studies were conducted in David Lake.

Mary Lou Lake has a surface area of 18 acres and a maximum depth of 21 feet. Dissolved oxygen concentrations during the critical months (March and April) were 6 ppm or more at a depth of 5 feet. The lake has an intermittent outlet which was blocked with 1/4-inch hardware cloth. Native fish species are sculpin and burbot.

Katherine Lake is located about 1 mile from Mary Lou Lake. The surface area is 30 acres and the maximum depth is 26 feet. This lake also has an intermittent outlet which was blocked with 1/4-inch hardware cloth. The lowest dissolved oxygen concentration encountered during March and April was 8 ppm at a depth of 5 feet. Native fish species consist of burbot and sculpin.

David Lake is located within 1/2 mile of Lake Louise, has a surface area of 40 acres and a maximum depth of 40 feet. The only outlet is intermittent and has been screened to prevent outmigration of fish. The only native fish species found were whitefish, burbot and sculpin.

These lakes have several characteristics in common. Indigenous native fish populations are relatively low. The lakes have adequate dissolved oxygen to overwinter salmonids. All three lakes have small, intermittent outlets which were physically blocked to prevent fish movement with 1/4-inch hardware cloth. None of the lakes have defined inlets.

These three lakes were all stocked with fingerling rainbow trout in 1982 and 1983. In 1982, David Lake was stocked at a rate of 500/acre, Katherine Lake was stocked at 300/acre and Mary Lou Lake stocked at a rate of 280/acre. In 1983, David Lake was stocked at 200 fish per acre, Katherine Lake at 300 fish per acre and Mary Lou Lake at 280 per acre.

Thirteen minnow traps were set in David Lake in 1983 and fished a total of 814 trap-hours. During this time only one rainbow trout was caught. In 1984, traps were fished a total of 592 trap-hours and again only one rainbow trout was caught. The one rainbow trout caught in 1983 was 123 mm in fork length and was from the 1982 stocking. In 1984, the rainbow trout caught had a fork length of 310 mm and was also from the 1982 stocking. Test-netting with two 125-foot variable mesh nets in 1984 caught only whitefish.

Minnow traps were used in Mary Lou Lake in 1983 and 1984. In 1983, the year following the initial rainbow trout stocking, 161 rainbow trout were caught in 1,214 trap-hours for a catch rate of 0.13 fish per trap hour. In 1984, 1,296 trap-hours caught only four rainbow trout. The lake was also test-netted in 1984 and three rainbow trout were caught for a frequency of 0.003 fish per net hour. These nets caught rainbow trout ranging from 204-243 mm in fork length and were from the 1982 plant.

Minnow traps were employed in Katherine Lake in 1983 and 1984. In 1983, one rainbow trout, seven sculpin and one burbot were taken in 990 trap-hours. In 1984, 558 trap-hours caught three sculpin and one burbot.

The conductivity of Katherine and Mary Lou Lakes was 53 and 62, respectively. By comparison Tolsona and Tex Smith Lakes have conductivities of 252 and 412, respectively. Conductivity is one factor used as an index of productivity. Tolsona and Tex Smith Lakes are considered as two of the more productive lakes managed in this area. In spite of an apparent adequate population of zooplankton in Katherine and Mary Lou Lakes, the very low conductivity strongly suggests their unsuitability for salmonids. Because of the low catch of rainbow trout in all three lakes, no population estimates were attempted.

Gulkana River Steelhead Trout Studies

The cooperative study of the Upper Copper River steelhead trout, initiated in 1982, was continued in 1983 and 1984 and is expected to terminate in 1985. The final stages of this study are being conducted by personnel of the U.S. Bureau of Land Management and A.D.F.& G.'s Division of Sport Fish.

The initial phases of this study included capture, biological data recovery, radio transmitter implantation and tracking of implanted fish, and were reported previously (Burger et al. 1983, and Williams and Potterville, 1983; 1984). In 1984 and 1985, priority was and will be given to studying known spawning and rearing areas of the upper Gulkana River.

Previous data and current findings in May 1984, show that the first 3-1/2 miles of the Middle Fork of the Gulkana River downstream from Dickey Lake and Hungry Hollow Creek downstream from Wait-A-Bit Lake are the primary known spawning areas of Gulkana River steelhead trout (Figure 2). Adult spawning escapement counts, juvenile rearing area data and a cursory physical data collection were initiated in these areas in 1984.

On June 1, 2, and 3, 1984, a jet Bell 206 helicopter was used to fly known spawning areas in the Gulkana River system for adult spawning enumeration. Adult steelhead trout counted in Hungry Hollow Creek and the aforementioned section of the Middle Fork of the Gulkana River revealed 60 and 63 spawning steelhead trout, respectively. Later on ground observations and electrofishing revealed approximately one third of the fish were missed in the aerial counts, so each area was estimated to contain 100 spawning steelhead trout.

Juvenile collection was attempted by both baited double-cone minnow traps and electrofishing. Because of time and aircraft fuel restraints, only two minnow traps were fished for a 24-hour period in each system. In Hungry Hollow Creek, minnow traps were fished 1/2 mile and 2 miles upstream from the mouth. The downstream trap produced three 80 mm chinook salmon and the upstream trap produced nothing. Backpack

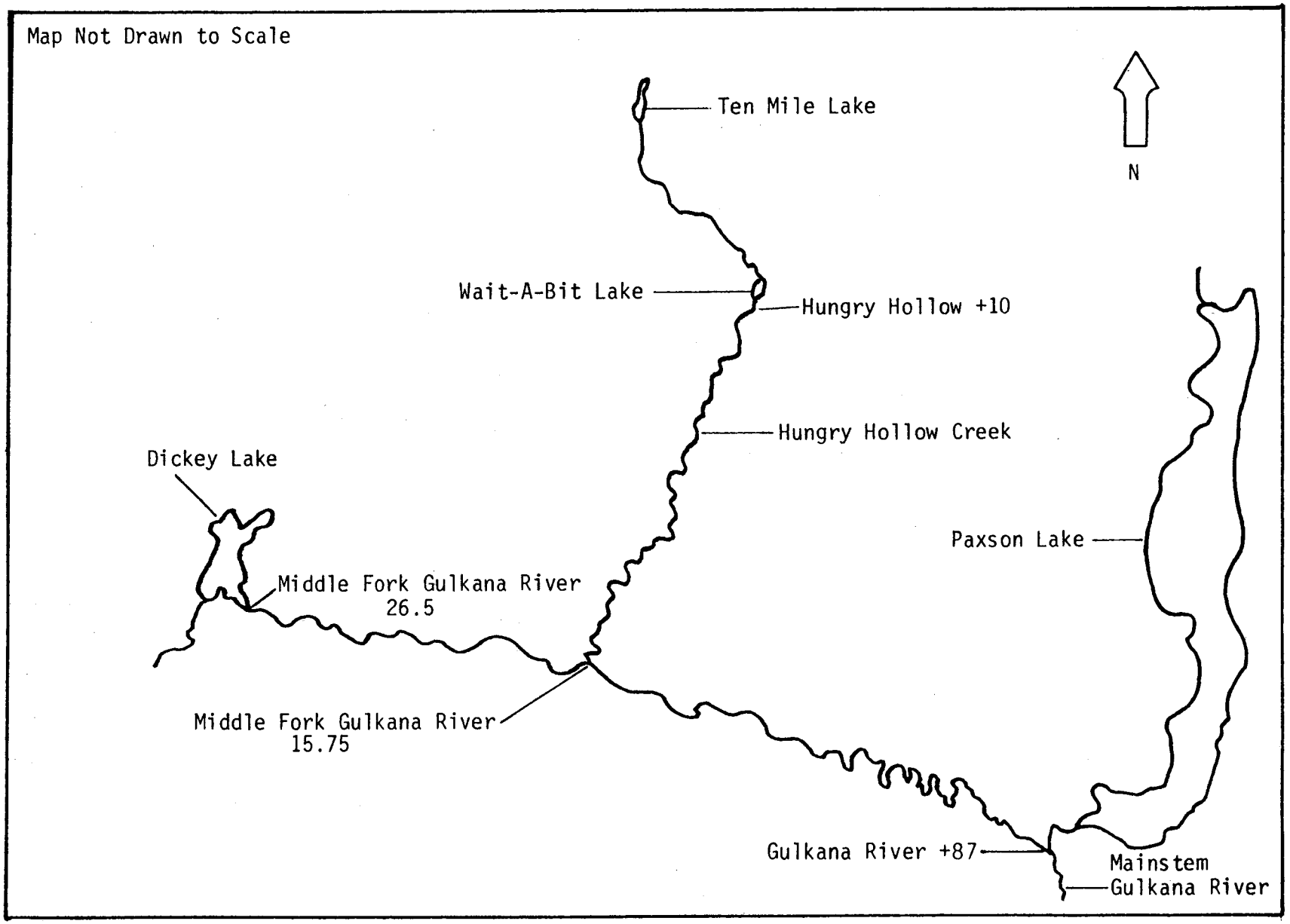

Figure 2. Map of 1984 Gulkana River steelhead trout study area.

electroshocking throughout the investigated portions of Hungry Hollow Creek produced sculpins and juvenile chinook salmon. Small numbers of rainbow trout and Arctic grayling too large for the minnow traps were observed but not captured. In the investigated portion of the Middle Fork (MF) of the Gulkana River, minnow traps were fished at MF +24 and MF +24.5 (Williams and Potterville, 1984). The trap at MF +24 captured one sculpin and the trap fished at MF +24.5 collected debris and floated up to the surface, catching nothing. Electrofishing in this portion of the river produced four chinook salmon fry, ranging from 33 to 75 mm and averaging 52 mm in fork length, and two age classes of juvenile rainbow trout. The juvenile rainbow trout were 118, 50, 50, 55 and 47 mm in fork length.

Physical characteristics of redds and resting/pairing areas were collected for both streams (Table 3). Resting/pairing areas are locations where steelhead trout have been observed in the paired mode. When the fish left these areas because of disturbance by humans, they later returned to the original location. Because of the timing and condition of the fish observed, it was felt that they would establish their redds in the same vicinity.

Backpack shocking recaptured two of the previously radio-implanted steelhead trout. A robust unspawned male carrying transmitter No. 0.932 was shocked off a redd at MF +25.5. Steelhead No. 0.482, a gravid female, was recaptured from an undercut bank at MF +23.5. This fish had another adult steelhead trout with her as well as numerous smaller rainbow trout in the 15 to 20 inch range. In both cases water velocities and instream physical conditions limited the recapture to just the targeted fish. Both fish were in prespawning condition and easily releasing milt and eggs; in neither case could the bulge of the transmitter be felt or observed. The incisions were healed, scar tissue was present and sutures were still in place. It is felt that both fish successfully spawned. Another redd was electroshocked, producing two adult steelhead trout, one 16-inch Arctic grayling and four rainbow trout from 12 to 16 inches in length.

In 1985, more precise observations and measurements will be made of the redd and resting/pairing areas. Also trapping and electrofishing activities will be intensified.

Test-Netting Managed Lakes

In 1984, 14 lakes in the area were test-netted (Table 4). Ten of these lakes were netted to determine success and growth of previous stocking. Four lakes were netted to determine trends in wild fish stock populations.

Arizona Lake has been stocked with grayling since 1968. There is evidence of natural reproduction in the lake. In 1971, there was a complete winter kill of grayling. Again in 1982 a winter kill occurred; however, it was not complete. Grayling were restocked in 1983 in an effort to re-establish a fishable population. This plant was not

Table 3. Physical parameters of steelhead redds and resting/pairing areas, Gulkana River drainage, June 1, 2, and 3, 1984.

Stream & Mile	Redd Area	Resting/ Pairing Area	Stream Bottom Temp. (°F)	Surface Gravel Size (in)	D.O. (ppm)	pH	Depth (ft)	Flow Velocity (FPS) 6/10 Depth	Flow Velocity (FPS) Bottom
HH+0.5*		X	40.0	...	...	7.3	...	...	...
HH+2.5		X	40.5	2-6	...	...	0.6	2.5	1.7
HH+4.5		X	41.0	2-4	...	...	1.0	0.8	0.6
HH+8		X	47.0	2-4	...	...	0.7	0.7	0.3
HH+9	X		42.0	1-2	10.6	7.8	0.6	1.5	1.1
MF+ 25.5**		X	42.0	...	12.0	7.2	...	...	...
MF+ 23.5		X	46.0	2-4	...	...	0.7	2.8	2.1

* HH+ 0.5 = 0.5 miles upstream from the mouth of Hungry Hollow Creek.
** MF+ 25.5 = 25.5 miles upstream from the mouth of the Middle Fork.

Table 4. Gill net summary of managed lakes, Copper River drainage, 1984.

Name	Location	Number of Fish	Species*	Length Range (mm)	Mean Length (mm)	Catch Rate (fish/hr)	Percent Composition
Arizona	T8N R7W S11	6	GR	105-125	115	0.46	100
Buffalo	T3N R7W S2 SE¼	55	RT	130-295	180	2.44	100
Crater (Lake Louise)	T4N R6W S29 NW¼	28	RT	105-470	245	1.27	100
David	T6N R7W S22 SE¼	19	WF	265-360	334	0.41	100
Dick	T13N R1W S31	17	GR	165-205	187	0.45	94
		1	BB	...	330	0.03	6
Hallie	T21S R11E S20 N½	0	..	...	...	...	...
Mary Lou	T5N R7W S10 SW¼	3	RT	204-243	220	0.13	100
Sculpin	T4S R7E S16	187	RT	100-410	244	3.76	100
Seven Mile	T21S R11E S15 N½	38	LT	125-480	350	0.82	88
		5	BB	280-310	292	0.11	12
Strelna	T4S R7E S7	50	KS	110-135	125	0.35	8
		595	SS	175-285	213	4.11	92

Table 4 (cont.). Gill net summary of managed lakes, Copper River drainage, 1984.

Name	Location	Number of Fish	Species*	Length Range (mm)	Mean Length (mm)	Catch Rate (fish/hr)	Percent Composition
Summit (rod & reel)	T6S R7E S28-33	0	...	...	...	...	...
		22	RT	495-813	691	...	100
Susitna	T7N, R8W	2	LT	320-535	428	0.03	2
		6	GR	165-235	192	0.08	4
		124	WF	95-410	246	1.70	91
		4	LNS	160-480	310	0.06	3
Van	T4S R7E S21	204	RT	100-400	213	5.13	99
		1	SS	...	490	0.03	1
Wait-A-Bit (Hungry Hollow)	T22S R10E S13	1	LT	...	570	0.04	1
		21	GR	115-275	199	0.78	15
		119	WF	120-470	235	4.39	84

* Species: see Table 1.

successful, or only partially so, since in 1985 test-netting caught only six grayling that ranged from 105-125 mm fork length. These fish also may have been from natural reproduction rather than from the 1983 plant. Another grayling fry plant was made in the lake in 1984.

Crater Lake, located on the Lake Louise Road, has been stocked with coho salmon and/or rainbow trout since 1965. The results of these plants have been inconsistent. Test-netting, conducted 13 times since 1965, has only twice (1979 and 1984) caught fish at a net frequency of 1.00 fish per hour or higher. In 1984, the net frequency for rainbow trout was 1.27 fish per net-hour. Almost all fish caught could be attributed to the 1982 stocking of Swanson River strain. Rainbow trout averaged 245 mm in fork length with a range of 105 to 470 mm. Maintenance stocking of this lake with rainbow trout will continue on a biennial basis.

Buffalo Lake is a small 4-acre lake located adjacent to the Glenn Highway. This lake has been stocked since 1970 with rainbow trout or coho salmon. The stocking of coho salmon has been terminated since 1978 because of early maturity. These fish generally mature 2 years after stocking and do not attain a size that is attractive to anglers. Swanson River rainbow trout were stocked in 1981 and 1983. Test-netting conducted in 1984 caught fish at a net frequency of 2.44 per hour which is the highest catch rate since testing started in 1970. This lake will also be stocked on a biennial basis at rates of approximately 250 per acre.

Hallie Lake, located on the Denali Highway, has a history of water level fluctuations. Although there is no outlet, the soil is apparently porous enough to allow underground runoff. This lake was stocked in 1971 with rainbow trout, in 1979 with coho salmon and, again, in 1983 with Swanson River strain rainbow trout. Test-netting conducted in 1973 caught no fish and implies total failure of the 1971 plant. Test-netting conducted in 1984 caught no fish. However, one coho salmon, 292 mm fork length, and two rainbow trout which ranged from 95-105 mm fork length, were caught on rod and reel in 5 angler-hours. The coho salmon was from the 1979 plant and the rainbow trout were stocked in 1983. The size of these fish indicates very poor growth which is aggravated by the fluctuating water levels and a short (4-month) ice-free period.

The 1983 plant was made at a rate of 250 per acre. In view of the poor habitat conditions in this lake, this is probably the maximum stocking rate and should be reduced.

Test-netting conducted in Dick Lake in 1983 produced no fish. This lake had been stocked with grayling four times between 1961 and 1983, and there was conclusive evidence of some natural reproduction. However, it was apparent that natural recruitment was not adequate to maintain the grayling population. This lake was restocked in 1983 with grayling fry and, in 1984, test-netting caught grayling that ranged in fork length from 165 to 205 mm and averaged 187 mm. This lake will be stocked on a

2-year frequency to maintain a fishable population. The lake is located adjacent to the Richardson Highway and has a history of local use.

Sculpin and Van Lakes, located on the Chitina-McCarthy Road, have been stocked with rainbow trout and coho salmon since 1968 and 1971, respectively. Both lakes have a reputation for producing excellent fishing. The rainbow trout fishing has been more popular with anglers than coho fishing because the rainbow trout generally live longer and attain a larger size. In 1982 and 1984, these two lakes were stocked with Swanson River strain rainbow trout. When the 1982 plants were made there was a declining population of coho salmon present which were stocked in 1979.

Sculpin Lake was test-netted in 1984, 24 days after rainbow trout were stocked at a rate of 200/acre. These fish averaged 45 mm in length when planted. A total of 187 trout were captured. Fifty-six of these fish were from the 1984 plant and averaged 110 mm in length. These rainbow trout more than doubled their size in less than a month. The 1982 stocked rainbow trout had reached an average size of 277 mm in the 23 months since they were stocked.

Van Lake was test-netted approximately 2 months after the 1984 rainbow trout plant. Two hundred four rainbow trout were captured, of which 128 were from the 1984 plant. These fish were from the same lot as the Sculpin Lake plant and averaged about 45 mm when planted. After 2 months in Van Lake these rainbow trout had attained an average length of 115 mm, which is only 5 mm more than the average length attained by the Sculpin Lake plant in a period of less than 1 month.

The 76 rainbow trout caught in Van Lake that were from the 1982 plant averaged 340 mm, which is considerably larger than the same lot of trout planted in Sculpin Lake in 1982 that averaged 277 mm fork length. For some unknown reason(s) these stocked rainbow trout grew much faster in Sculpin Lake during the initial period but later, probably the next summer, the fish grew at a more rapid rate in Van Lake.

The growth rate in Van and Sculpin Lakes is higher than in most of the other lakes in the area. This is due to: (1) the relatively high productivity of the lakes; (2) the longer ice-free period (at least 1 extra month); and (3) the lower stocking density. Van and Sculpin Lakes were stocked at rates of 160 and 200 per acre, respectively, which is lower than other stocked lakes in the area.

The net frequencies of 3.76 and 5.13 fish per net-hour from Sculpin and Van Lakes in 1984 are the highest ever recorded since test-netting began in 1969.

In 1984, chinook salmon fingerlings, averaging 55 mm in length, were stocked in Strelna Lake at a rate of 240/acre. Coho salmon from a 1979 plant were also present in the lake. In September 1984, 3 months after the chinook salmon were stocked, 50 were taken with fyke traps. These chinook salmon ranged in fork length from 110 to 135 mm and averaged 125 mm. This growth is similar to that of rainbow trout fingerlings planted in adjoining lakes, Sculpin and Van, in 1984.

Seven Mile Lake, located near the Denali Highway, is accessible by highway vehicle via a 1/4-mile gravel road. This lake has been under our management program since it was first surveyed in 1960. The population of fish is primarily lake trout, although several burbot have been captured during test netting conducted 5 different years from 1960 to 1984. In 1976, grayling were taken in gill nets and were presumably a result of spawning adults entering the outlet from a downstream lake during unusually high water. In 1984, 38 lake trout were taken with test nets for a frequency of 0.82 fish per net hour. This is slightly higher than the weighted average net frequency of 0.75 for the years preceding. The lake trout ranged from 125 to 480 mm in fork length and averaged 350 mm. No large lake trout have ever been taken with nets or reported taken with sport gear in Seven Mile Lake. It is doubtful if large lake trout will ever be produced from this lake because of a lack of forage fish in the food chain. This lake receives only moderate fishing effort and the population of lake trout does not appear altered in any way since 1960. The smallest (125 mm) and the largest (480 mm) lake trout taken during the test-netting history of this lake were captured in 1984.

In 1984, steelhead trout investigations revealed the importance of Hungry Hollow Creek as a spawning area. Since Wait-A-Bit Lake is located on that drainage, test-netting, trapping and electrofishing activities were conducted in summer of 1984 to determine if the lake might be used as a rearing area for juvenile steelhead trout. Nets were set in the lake, traps installed in the inlet and outlet, electrofishing was done where practical and sport fishing gear was employed in an effort to collect steelhead trout. The only fish captured in this effort were grayling, whitefish, sculpin and lake trout. This lake apparently has a small lake trout population as evidenced by fish collection records from 1969 and 1984; however, it does have a large whitefish population. The lake is utilized very little by anglers since it is several miles south of the Denali Highway and there was no physical evidence of use.

Mary Lou and David Lakes, located near the Lake Louise Road, were experimentally stocked with rainbow trout in 1982 and 1983. Surveys of these lakes, including plankton studies, indicated they would be receptive to establishment of a rainbow trout fishery. In 1984, test-netting in David Lake caught no rainbow trout. Extensive trapping conducted at the same time captured only one rainbow trout (310 mm) which was from the 1982 plant.

Test netting conducted in Mary Lou Lake caught only three rainbow trout which were from the 1982 plant. Trapping was also conducted and four rainbow trout from the 1982 plant were caught. These fish ranged in length from 204 to 243 mm and averaged 220 mm in fork length. Assuming that the fish were healthy when stocked, the results strongly indicate these lakes are unsuitable for rainbow trout. These lakes are discussed in more detail in the "Population Estimates" section.

Summit Lake:

In 1984, a joint field trip was made to Summit Lake by personnel of the National Park Service and our Division of Sport Fish. This 320-acre lake is located 16 miles southeast of Chitina in the Wrangell-St. Elias National Park. The purpose of the trip was to continue investigations, initiated in 1983, of the lake and the population of large rainbow trout. The initial survey was in response to reports of large fish observed in a lake that was assumed to be barren.

In 1983, limited sounding was done and 22 rainbow trout were collected. The 3-day field project in 1984 was focused on collection of additional age-length data, completing sounding and mapping of the lake (Figure 3) and observations of spawning activities.

Two variable mesh gill nets were set in the west end of the lake, almost 2 1/2 miles from the outlet. No fish were caught in these overnight sets. Angling efforts and visual observations indicated that most of the fish were concentrated in the outlet and the eastern end of the lake. One test net was also fished for a few hours in the largest inlet which enters the lake at the extreme western end. This tributary yielded all of the Age I and II fish collected (Figure 4). A series of old beaver dams dike this tributary, but it did not appear that they would block fish passage. The substrate of that stream is composed of good spawning gravel; however, no spawning rainbow trout were captured or observed in it. Another small tributary on the south side also appeared to have limited spawning and rearing habitat but no rainbow trout were observed in it. The temperature of this inlet was only 43° F.

Adult rainbow trout in the 20- to 30-inch length range were observed along the northeast shore of the lake. Three of these fish were captured via rod and reel. They ranged from 610 mm to 813 mm and averaged 720 mm. These fish were not sexually ripe and were actively feeding on snails in the shallows. The remaining 19 sampled rainbow trout were sport-caught near the outlet. No conclusions can be reached because of the small sample size; however, there was an absence of Age III and IV fish. Data for 1984 verify there were Age IV rainbow trout in the lake in 1983 when none were captured. Two years of limited sampling have never produced a 3- or 4-year-old fish. Reasons for this could be that those age classes are: (1) very limited in number; (2) residing in an unsampled area of the lake; (3) missed because of net avoidance; (4) sexually immature and; (5) not in the shallows where they can be captured or observed.

Two areas of the lake were found to contain ripe rainbow trout. The shoal area of the lake within 300 yards of the outlet had some ripe adults. The substrate in this area was small gravel up to 1 1/2 inches in diameter. This area of the lake has a minor current as it drains into the outlet. It is not known if these fish were spawning or just holding in this area.

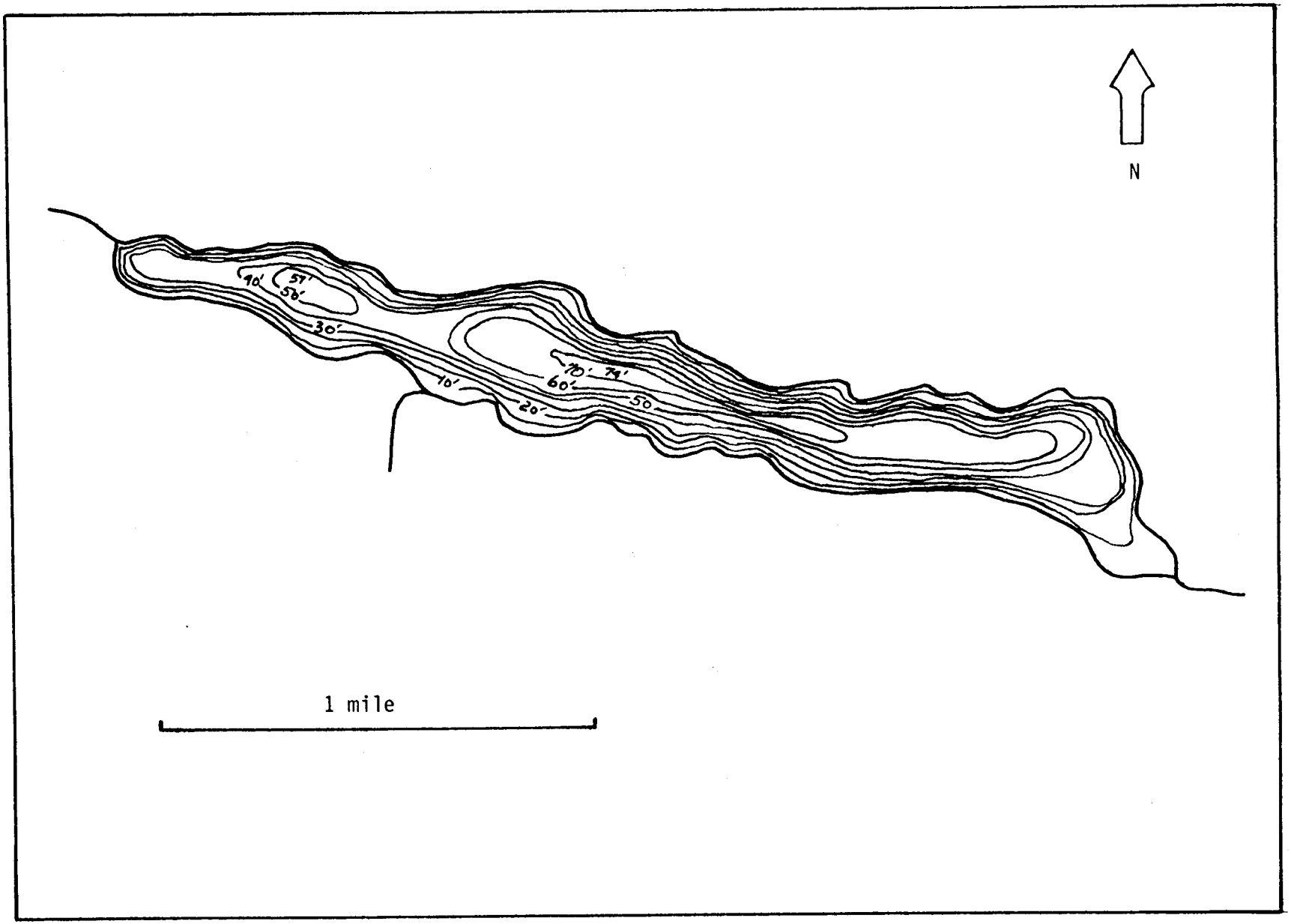

Figure 3. Summit Lake contour map.

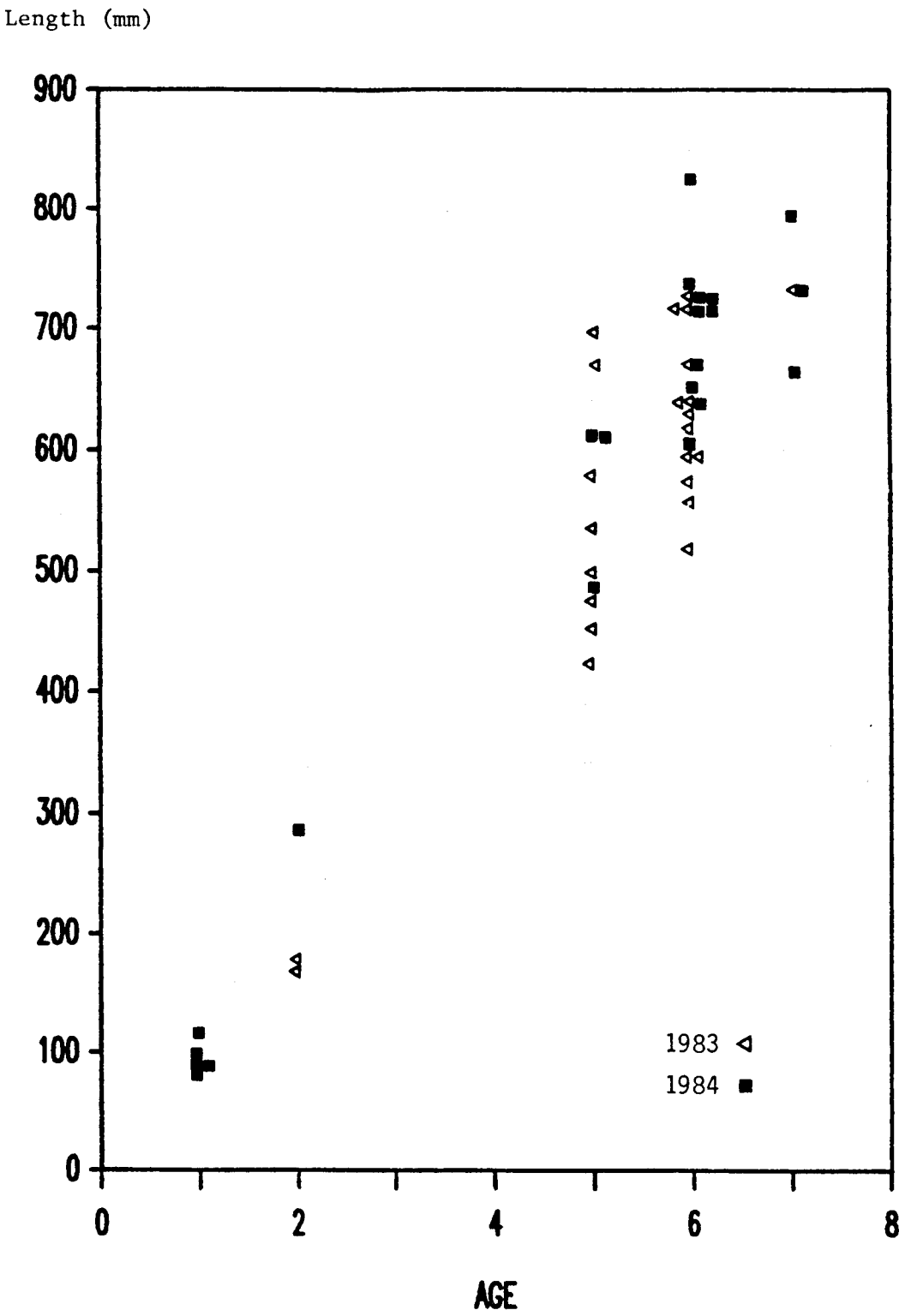

Figure 4. Summit Lake rainbow trout age length frequencies, 1983-1984.

The majority of spawning rainbow trout were found in the first 250 yards of Bridge Creek, the outlet stream. This section of the outlet varies from 10 to 30 feet in width and the velocities are rapid. The stream below this point is narrow and torrential with little spawning or rearing area. The substrate size in the spawning area ranges from 2 inches to rubble and appears to be excellent for spawning. The water is extremely clear and there was little evidence of deposition of any silt in the gravel. This was also observed in August 1983. On June 25, 1984, the water temperature was 52° F.

A foot survey was made of the 250-yard spawning area and the number of spawning rainbow trout was estimated at 200. Grizzly bears were observed on the spawning grounds and evidence of partially eaten fish indicated there may be significant predation on the spawning rainbow trout.

Observations of the stream indicated when bears entered the spawning area, the fish returned to the lake. The deepest part of the spawning area did not exceed 24 inches; also the clarity of the water may have alarmed the fish causing them to return to deeper water. There were at least three grizzly bears in the area.

It appears that the population of rainbow trout in Summit Lake is relatively small. Only a very small number of Age I and II fish have been captured or observed. The peak of spawning activity is in late June and early July. It takes about 30 days for the eggs to hatch assuming the water would maintain the June 25 temperature of 52° F. It is not known when the fry emerge from the gravel, but this could be occurring late in August when water temperatures are dropping. Because of the physical characteristics of the outlet, many of the emerging fry could easily be washed downstream where the water flow is so torrential it could preclude movement back upstream. Predation on the fry and fingerling rainbow trout by larger fish may be relatively high because of water clarity.

The population of rainbow trout in Summit Lake appears to be quite fragile and heavy fishing pressure could rapidly deplete their numbers. The fish are very vulnerable during the spawning period because they are concentrated in a small area in the inlet. This system should be managed carefully to prevent overharvest and depletion of these trophy-sized rainbow trout.

Surveys of Previously Unmanaged Lakes

In 1984, nine previously unmanaged lakes were surveyed. These surveys included test netting and a compilation of physical characteristics of the lakes (Tables 5 and 6). Five of the lakes surveyed are in the Lake Louise area. They are within, or adjacent to, a state recreational land disposal area. The five lakes, Blue, Judd, Nye, Little Loon and Wrong, ranged in size from 10 to 120 acres and had populations of Arctic grayling, burbot, whitefish and suckers. The lakes ranged in maximum depth from 21 to 27 feet.

Table 5. Gill net summary of previously unsurveyed lakes, Copper River and Susitna River drainages, 1984.

Name	Location	Number of Fish	Species*	Length Range (mm)	Mean Length (mm)	Catch Rate (fish/hr)	Percent Composition
Blue	Gulkana A-6 T5N R9W S13,14	11	GR	160-170	165	0.73	100
Butte	Healy A-2 T20S R2W S12,13,14,23	7	LT	460-500	476	0.17	13
		27	GR	120-420	330	0.64	51
		19	WF	260-385	340	0.45	36
Judd	Gulkana A-6 T5N R8W S1,2	25	GR	105-205	150	0.59	16
		2	BB	235-610	423	0.04	1
		96	WF	125-355	226	2.28	63
		31	LNS	110-460	313	0.73	20
Little Loon	Gulkana A-6 T5N R8W S13,24	3	GR	235-255	245	0.06	2
		60	WF	125-355	278	1.29	48
		62	LNS	270-515	414	1.38	50
Myrtle	Gulkana A-5 T4N R6W S26	54	GR	100-395	278	1.14	100

Table 5 (cont.). Gill net summary of previously unsurveyed lakes, Copper River and Susitna River drainages, 1984.

Name	Location	Number of Fish	Species*	Length Range (mm)	Mean Length (mm)	Catch Rate (fish/hr)	Percent Composition
Nye	Gulkana A-6 T5N R8W S3,4,10	20	GR	110-380	288	1.30	100
East Twin	Valdez D-8 T2N R9W S23,24	154	GR	100-330	167	3.46	84
		1	DV	...	225	0.02	1
		11	WF	240-390	323	0.24	6
		17	LNS	105-450	377	0.38	9
West Twin	Valdez D-8 T2N R9W S27,28,32,33	14	GR	105-250	212	0.33	20
		1	BB	...	440	0.02	1
		39	WF	170-310	246	0.91	56
		16	LNS	110-390	185	0.38	23
Wrong	Gulkana A-5 T5N R7W S10 E 1/2	27	GR	120-270	197	1.12	96
		1	BB	...	365	0.04	4

* Species: see Table 1.

Table 6. Physical and biological data from previously unsurveyed lakes in the Copper River and Susitna River drainages, 1984.

Name	Surface Area (acres)	Maximum Depth (ft)	Percent of Shoal Area**	Fish Species* Present	Location by Drainage	U.S.G.S. Map Reference
Blue	45	25	30	GR	Mendeltna Springs to Tazlina River	Gulkana A-6
Butte	680	54	5	LT, GR, WF	Butte Creek to Susitna River	Healy A-1
Judd	100	22	20	GR, BB, WF, LNS	Mendeltna Creek to Tazlina River	Gulkana A-6
Little Loon	120	27	65	GR, WF, LNS	Lake Louise to Susitna River	Gulkana A-6
Myrtle	10	17	80	GR	Unnamed - Tazlina River	Gulkana A-5
Nye	60	25	50	GR	Mendeltna Creek to Tazlina River	Gulkana A-6
East Twin	240	5	100	GR, DV, WF, LNS	Nelchina River to Tazlina River	Valdez D-8
West Twin	460	48	10	GR, BB, WF, LNS	Nelchina River to Tazlina River	Valdez D-8
Wrong	10	21	15	GR, BB	Lake Louise to Susitna River	Gulkana A-5

* Species: see Table 1.
** Shoal area includes those areas less than 15 feet deep.

East and West Twin Lakes are located in the Nelchina River drainage and have surface areas of 240 and 460 acres, respectively. During test-netting, Arctic grayling, burbot, whitefish, suckers and Dolly Varden were captured from both lakes. East Twin Lake has a maximum depth of only 5 feet, but 154 of the 168 grayling captured with test gill nets came from that lake. West Twin Lake has a maximum depth of 48 feet and it is assumed that East Twin Lake fish overwinter there. The lakes are connected by approximately 1 mile of stream. These lakes are also located within a state land disposal area.

Butte Lake is located 5 miles southwest of the Denali Highway. This 680-acre lake has a maximum depth of 54 feet but only approximately 5% shoal area. The lake is situated at an elevation of 3,350 feet and is ice-free approximately 4 months of the year. This lake has been considered as an Arctic grayling egg take site. Twenty-seven Arctic grayling taken with test gill nets ranged in fork length from 120 to 420 mm and averaged 330 mm. Twenty taken with rod and reel ranged from 230 to 400 mm in fork length and averaged 313 mm. The lake is accessible by ATV and aircraft; however, during the time that grayling would be spawning, ice on the lake would make aircraft landing prohibitive. In 1983, when the lake was first investigated, it was 99% ice-covered on June 4 and the largest inlet and the outlet had water temperatures of 39° F, which is considered the optimum temperature to trigger a spawning migration. At that time very few grayling were observed in the two streams.

Myrtle Lake, at Mile 162 Glenn Highway, is 10 acres in size with a maximum depth of 17 feet. The lakeshore is in both private and public ownership and primarily spruce bog with a few scattered aspen. During test-netting only Arctic grayling were captured. Grayling were primarily Age II and V with a 6-year-old the oldest captured fish. Myrtle Lake does not have any apparent spawning areas suitable for grayling. It has no permanent inlets or outlets. This population may be a result of transplanting fish from other waters.

Burbot Investigations

In 1984, 46% of all burbot caught in Alaskan waters came from the Copper River Basin (Mills, 1984). Historically, Copper River Basin lakes have been the number one producer of Alaska's freshwater cod, also called burbot. Management of this resource has been based on a limited cursory collection of data from sport fishermen. Data from sport-caught fish are biased against juvenile fish in that many sport fishermen release smaller fish, thus those data are lost to the biologist. In the case of burbot, this bias is also caused by gear limitations; a 3/4-inch gap hook is required for sport fishing, consequently smaller fish do not engulf the large bait on that size hook. Also, the diet of young burbot up to approximately 500 mm in length consists of mainly immature aquatic insects, crayfish, mollusks and other deepwater invertebrates, but relatively few fishes (Scott and Crossman, 1973).

Burbot are generally pursued in the winter months by ice fishermen. Since cold weather in mid-winter generally reduces the effort by burbot fishermen, this mid-winter "lull" allows the capture data to be broken

into two sections: (1) early winter, generally November and early December; and (2) late winter, which includes late January, February and March. Alaskan freshwater burbot spawn in January, February and March; therefore, there is a sport fishery on the spawning population.

To understand and manage the resource, two area lakes are monitored that are popular winter fisheries for burbot. Historically Moose Lake is a fall burbot ice fishery and Hudson Lake a late winter burbot ice fishery. Because Moose Lake burbot are prespawners and Hudson Lake are pre and postspawners, sexual maturity cannot be compared, but it is monitored and recorded for annual comparisons. Intra-lake juvenile data from both lakes are lacking.

Moose Lake Burbot:

Moose Lake, located approximately 1 1/2 miles north of Mile 179 Glenn Highway, supports a native population of burbot, grayling, suckers and introduced rainbow trout. The lake has a surface area of 320 acres and a maximum depth of 24 feet.

During the winter of 1970-71, there was a heavy winter kill of fish in Moose and Tolsona Lakes. Sport fishing efforts during the winter from 1971 through 1980 were not successful for burbot and none were caught in test gill nets until 1978. The same winter die-off in Tolsona Lake was not as severe and burbot have been taken with test nets and sport fishing since that time. Moose and Tolsona Lakes are connected by a 1,500 foot stream which normally flows all summer. Occasionally burbot are seen in the stream but apparently recruitment of burbot into Moose Lake was not extensive.

Winter fishing for burbot has been light until 1982, when approximately 75 set lines were observed on one field trip. During November of 1982, 85 burbot were collected from Moose Lake. Otoliths were read for aging data and 79% were Age VI or older.

In November 1984, 55 burbot caught on hook and line were aged. The age-length relationships are shown in Figure 5. Seventy-seven percent of the 1984 sport-caught burbot were Age VI or Age VII, with the youngest Age V and the oldest Age X. A comparison of previous data with that collected in 1984 shows that the Moose Lake burbot population is healthy and shows little change.

Hudson Lake Burbot:

Hudson Lake, located approximately 16 trail miles west-southwest of Copper Center, supports a native population of burbot, whitefish, rainbow trout and suckers. The lake has a surface of 640 acres and a maximum depth of 51 feet.

Historically Hudson Lake has been one of the most productive burbot fisheries in this area. In 1973, it was estimated that in excess of 3,000 pounds of burbot were sport-caught from the lake. In 1974, one

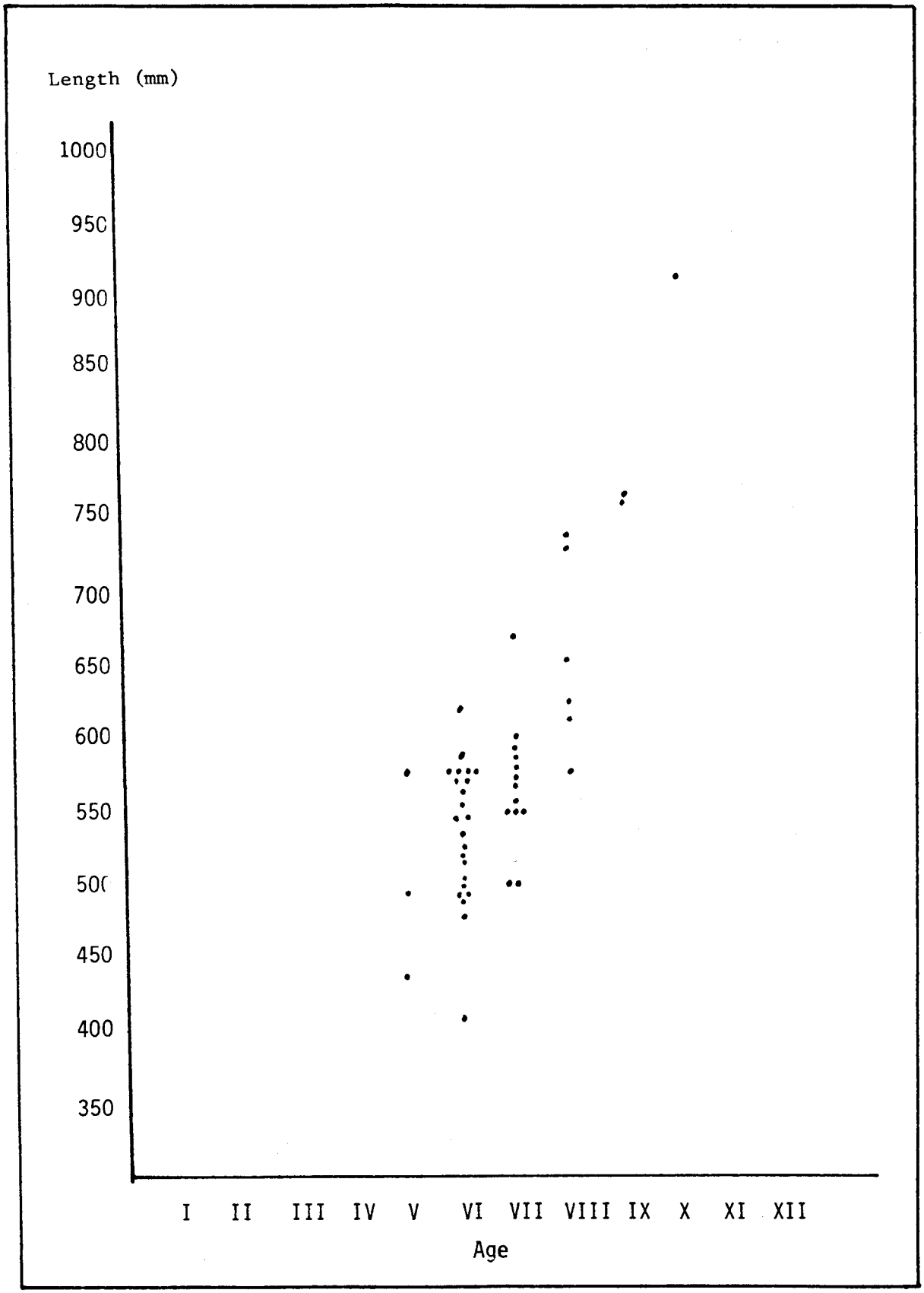

Figure 5. Age length relationship of Moose Lake burbot, November 1984.

family reported catching 140 burbot on a weekend outing. In 1977, a fisherman reported that, at one time, there were five airplanes on the ice plus numerous snowmachines. Similar activity was noted in 1984-85.

In spite of this relatively heavy pressure on the burbot fishery, the population is in good condition. The majority of the catch continues to be older fish and little change is noted from 1974 to 1985. Age-length frequency data for 1984-85 are shown in Figure 6. In 1984-85, Age IX and older burbot comprised 78% of the catch from Hudson Lake. In 1974-75 (Williams, 1975) 70% of the catch were Age IX or older fish. During both winter fisheries the youngest recorded fish caught was Age VI.

Grayling Egg Take Investigations

Arctic grayling egg take investigations were conducted at Moose, Jack and Tahneta Lakes. Butte and Scoter Lakes were scheduled for investigation as egg take sites but omitted because there were no adequate funds or personnel.

Moose Lake Grayling:

A trap was installed in Our Creek, inlet to Moose Lake, on May 4 when the stream temperature was 36°F. In 1983, the trap was installed on the same date when the water temperature was 37°F (Table 7). In both years large migrations of grayling into the stream did not develop until the water reached a temperature of 38°F.

In 1983, 13% of the females handled had bloody eggs. In 1984, the number of females with bloody eggs was down to 8%. The reason for this condition is not known, although handling of the fish may be a factor.

In 1984, carbon dioxide was used to anesthetize the fish before stripping the eggs and milt. Prior to spawning, the fish were placed in a container of water saturated with carbon dioxide. Within 2 1/2 minutes the fish were inactive and easy to handle. The carbon dioxide reduces the blood pH and the oxygen transporting capacity of the hemoglobin which impairs respiration.

After being artificially spawned, the fish recovered from the effects of the carbon dioxide in the same time it took to anesthetize them. No evidence of delayed mortality was observed. This technique reduces handling stress and makes it much easier to strip the eggs and milt.

The use of air to force eggs from the females was tried and again proved unsuccessful. The fish are apparently too small for air to work successfully. The process takes more time than hand stripping eggs. Also since these grayling do not all ripen at the same time, there is the risk of injury to fish and eggs by forcing out immature eggs.

In 1983, 500 of the grayling trapped at Our Creek were marked by removal of the adipose fin. In 1984, 299, or 60%, of these fish were again trapped at Our Creek. This implies a good survival of repeat spawners.

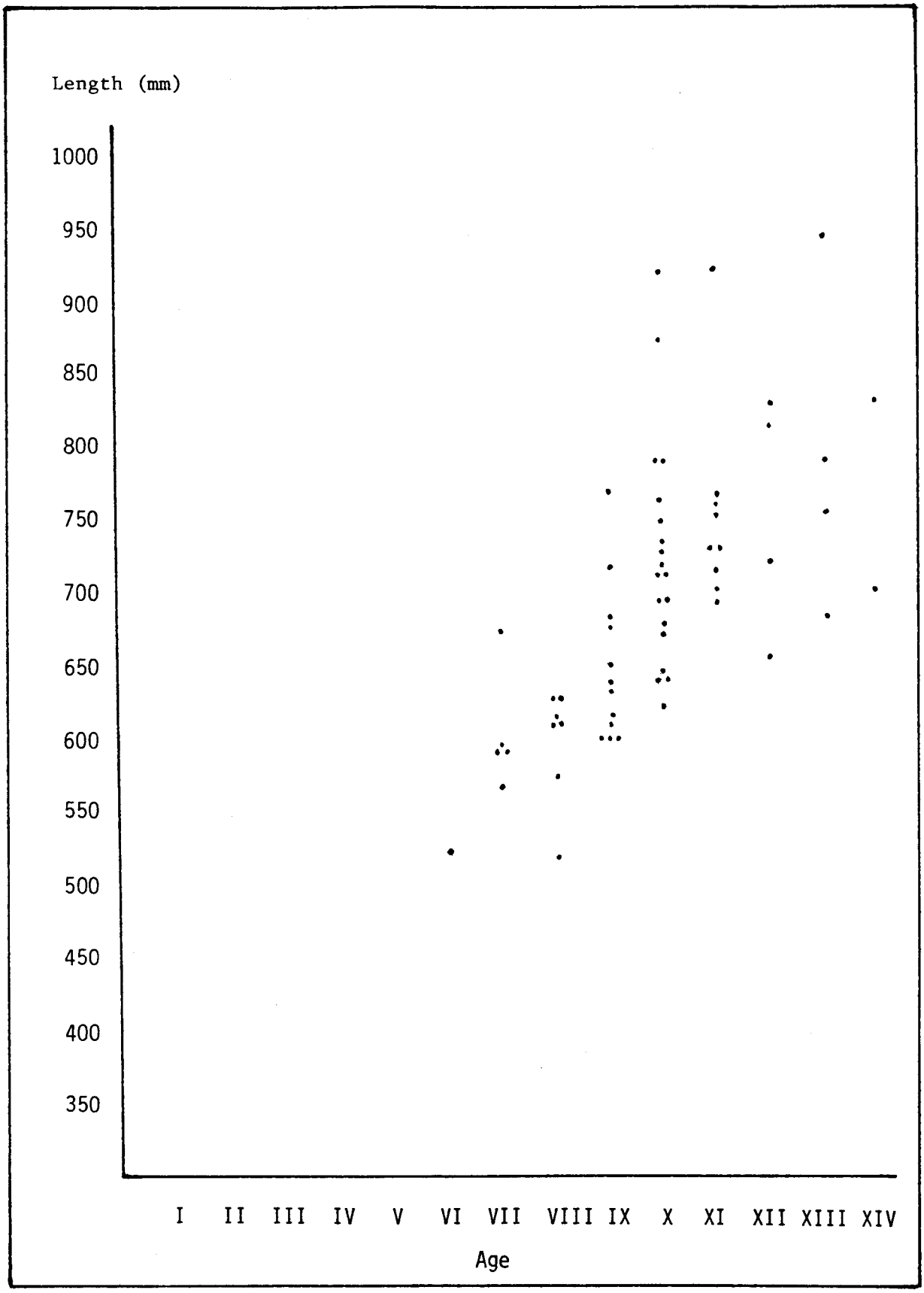

Figure 6. Age length relationship of Hudson Lake burbot, February 1984 and January 1985.

Table 7. Moose Lake (Our Creek) grayling egg take investigations, 1983-1984.

	1983	1984
Trap installed:	May 4	May 4
Water temperature:	37°	36°
Total grayling trapped:*	1,274	1,632
Total males trapped:	657	783
Total females trapped:	617	849
First egg take:	May 13	May 15
No. of females used:	152	216
No. of eggs obtained:	658,690	1,084,000
Average fecundity:	4,333	5,019
Second egg take:	May 16	May 19
No. of females used:	103	200
No. of eggs obtained:	374,640	985,000
Average fecundity:	3,637	4,925
Total eggs:	1,033,330	2,069,000
Fish marked (adipose clip):	500	
Marked fish retrapped:		299
Percent of marked spawners returning second year:		60%

* The trap was pulled when the number of fish captured dropped significantly and when adequate fish were being held for the egg take.

Fecundity of spawned females was higher in the first egg take than in the second egg take during both years. This is because larger, older female grayling mature earlier and there is a tendency for egg takers to select the larger fish.

Tahneta Lake Grayling:

Tahneta Lake is located at Mile 123 Glenn Highway at an elevation of 2,960 feet. This lake has a surface area of 180 acres and a maximum depth of 10 feet. At least 75% of the lake is 6 feet deep or less. The lake is fed by two permanent inlets and several intermittent streams.

In 1983, test netting caught grayling at a rate of 4.64 fish per net-hour. Based on this indication of a large grayling population, studies were initiated to determine if a grayling egg take site could be established.

On May 22, 1984 a trap was installed at the outlet to capture in-migrating grayling. Since winter dissolved oxygen levels were less than 0.5 ppm, it was suspected that fish did not overwinter in the lake. The trap was fished for 4 days and only a few grayling were captured; however, fish were observed above (lake side) the trap. The trap was then reversed and, by the next morning, 300 grayling had been captured. Since some of the fish were ripe, eggs were taken from 15 female grayling. The fecundity averaged 2,266 eggs per female. The trap was removed and the project was discontinued because of other activities elsewhere that required immediate attention.

Had the trap been installed correctly at the outlet, more grayling would probably have been captured. Winter dissolved oxygen determinations conducted in winter 1984-85 revealed an area of the lake with 5 ppm. This information plus the trapping results at the outlet refute our earlier postulations that grayling do not not overwinter in Tahneta Lake.

In 1985, traps will be installed again in the outlet and also in the major inlet located in the northeast corner of the lake. Because of the population of grayling indicated by test netting and trapping and the proximity of the lake to a major road system, this system has major potential as a grayling egg take site.

Jack Lake Grayling:

Fyke traps were installed in the primary inlet of Jack Lake on May 12, fished for 8 days and 490 grayling were taken. Since adequate eggs for hatchery requirements were secured at Moose Lake, only 15 female grayling from Jack Lake were stripped. A total of 62,900 eggs were collected for an average fecundity of 4,193 per female. Since the 1985 effort will be directed toward Moose and Tahneta Lakes, no plans have been formulated for Jack Lake in the coming year.

Stream Surveys - Electrofishing

During summer 1984, 24 roadside streams along the Richardson, Nabesna, Tok and Glenn Highways were electrofished. Most of the electrofishing was limited to stream areas immediately upstream and downstream from the highway crossings. A backpack shocker was used for fish collection.

During this activity the presence of chinook salmon smolt was established in 10 streams which had previously been classified as nonanadromous (Table 8). Coho salmon smolt were also found for the first time in two streams. Grayling were captured in only 12 of the streams. Some fish were probably missed because the backpack shocker is limited in range and effectiveness, and some of the areas selected may not have been desirable fish habitat.

Gulkana River Arctic Grayling

The Gulkana River supports one of the largest Arctic grayling sport fisheries in Alaska. According to the Statewide Harvest Survey (Mills, 1984), anglers kept 9,683 Arctic grayling in 1983. Angler interviews have shown that they keep only about 12.5% of the Arctic grayling they catch from the river, so the total catch (released plus kept fish) is much higher than the survey indicates.

The Division of Sport Fish annually monitors the Arctic grayling fishery by sport catching and measuring as many fish as possible from the upper section of the river. This is done during one or two 3-day float trips in a fashion similar to the methods used by sport anglers. The data collected are used to gather life history information, monitor year-to-year changes in the catch rate and collect age-length information.

In 1984, 304 Arctic grayling were sport-caught for measurements, scale samples and comparison to previous years' data. Most of the fish caught from 1979 through 1984 were between 230 and 330 mm in fork length (Figure 7). The frequency of fish sizes caught through 330 mm in fork length does not represent the actual population size composition. The smaller fish, which are most abundant, comprise only a small percentage of the sport catch.

The average fork length of 1,037 grayling examined from 1968 through 1983 is 283 mm (Table 9). In 1984, the average fork length was 271 mm. This difference is not considered significant.

Valdez Stream Surveys

Enumeration of spawning salmon in eastern Valdez Bay is conducted annually. Four species of Pacific salmon were counted in the index streams in 1984 (Figure 8 and Table 10). These species are pink, chum, coho and sockeye salmon.

Table 8. Results of electrofishing streams on road system, Glennallen area, 1984.

Stream	Principal Drainage	Fish Species Captured*
Gillespie Creek	Gulkana River	KS, GR, BB, SSC
Haggard Creek	Gulkana River	GR
Poplar Grove Creek	Gulkana River	KS, GR
Sourdough Creek	Gulkana River	KS, GR
Bear Creek	Gulkana River	KS, GR
Start-Up Creek	Tazlina River	...
Cache Creek	Tazlina River	GR
Mendeltna Creek	Tazlina River	...
Farm Creek	Tazlina River	...
Woods Creek	Tazlina River	KS, GR
Little Woods Creek	Tazlina River	...
Tolsona Creek	Tazlina River	KS
Moose Creek	Tazlina River	GR
Willow Creek	Tonsina River	GR
Squirrel Creek	Tonsina River	SS
Twin Lakes Creek	Jack Creek	GR
Little Jack Creek	Jack Creek	...
Yetna Creek	Copper River	KS, SS
Rock Creek	Copper River	...
Dry Creek	Copper River	KS, GR
Sinona Creek	Copper River	KS
41 Mile	Copper River	KS, GR
Canyon Creek	Copper River	...
Rufus Creek	Copper River	DV

* See Table 1.

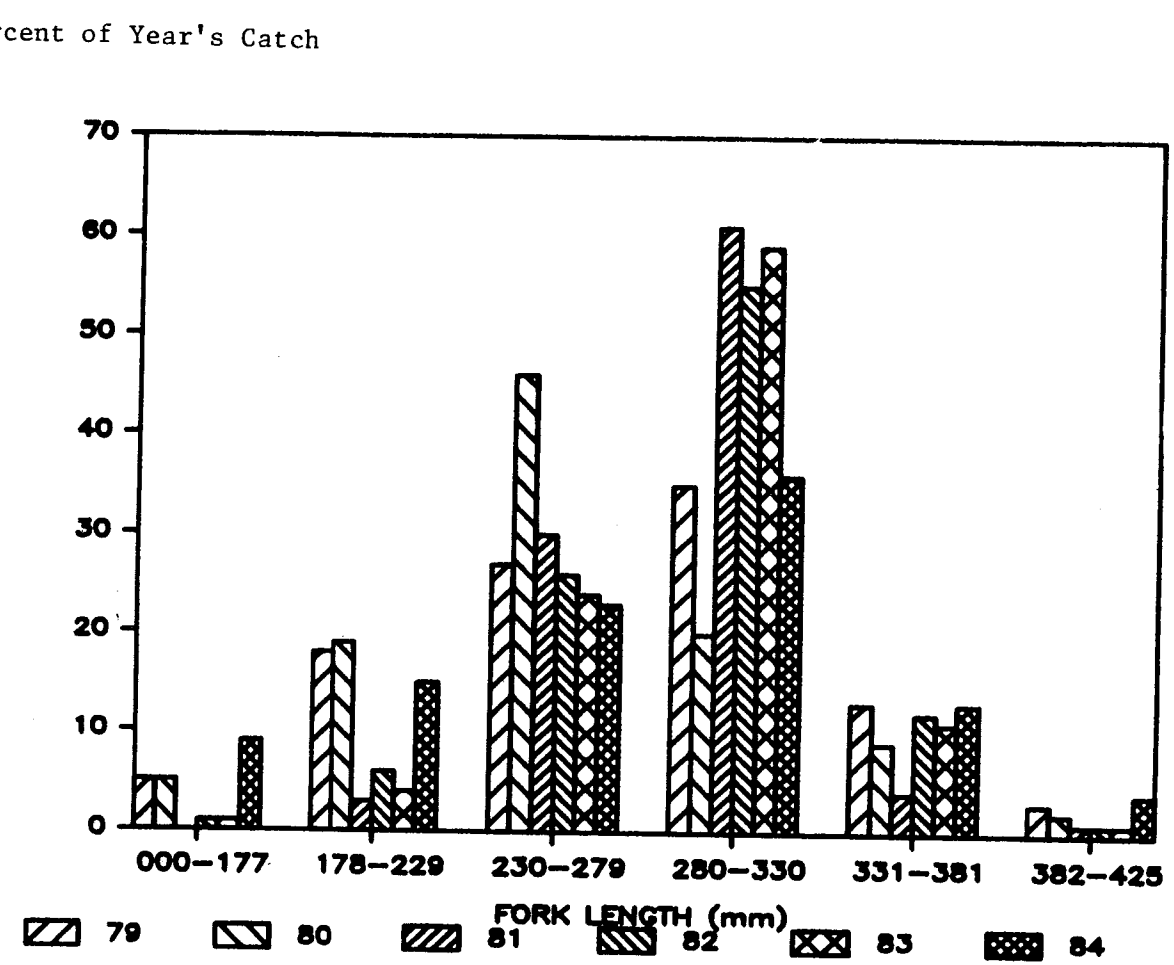

Figure 7. Percent of catch by length frequency of Gulkana River Arctic grayling, 1979-1984.

Table 9. Arctic grayling length data for Gulkana River, 1968 and 1978-1984.

Year	Number of Fish	Length Range (mm)	Average Length (mm)
1968	100	177-425	290
1978	190	177-425	294
1979	146	86-420	273
1980	137	95-400	268
1981	145	190-390	287
1982	307	130-385	272
1983	412	152-385	296
1984	304	150-405	271

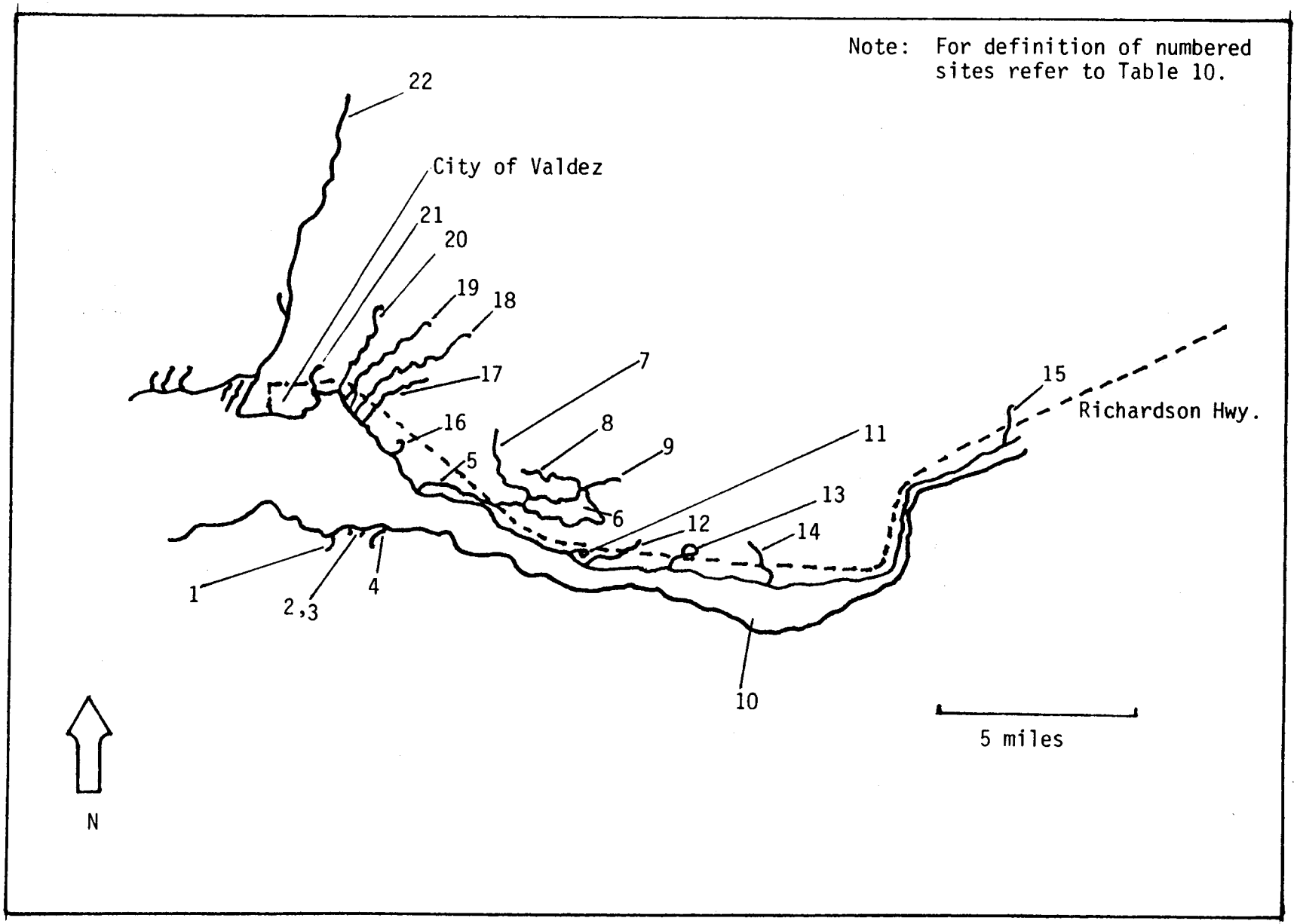

Figure 8. Salmon spawning streams, upper Valdez Bay.

Table 10. Valdez area salmon enumeration streams.

	Anadromous Stream Number	Name	Count Areas
1.	221-60-11360	Solomon Gulch	Waterfalls downstream. Includes Solomon Gulch hydro-electric power plant tailrace area.
2.	221-60-11364	Dayville Flats intertidal pools	Entire drainage
3.	221-60-11366	Dayville Flats intertidal pools	Entire drainage
4.	221-60-11368	Abercrombie	Entire drainage
5.	221-60-11380	Robe River	Entire drainage
6.	221-60-11380-0010	Robe Lake	Outlet area
7.	221-60-11380-2095	Corbin Creek	Entire drainage
8.	221-60-11380-2105	Brownie Creek	Entire drainage
9.	221-60-11380-2107	Deep Creek	Mouth area
10.	221-60-11370	Lowe River System	Selected areas
11.	221-60-11370-2145	4.5 Mile Pit	Outlet and outlet stream
12.	221-60-11370-2165	6.5 Mile Seep	Entire drainage
13.	221-60-11370-2219-3011	8.5 Mile	Entire drainage
14.	221-60-11370-2219	12 Mile	Alpine Woods streams Fire station area streams Sandvick pool
15.	221-60-11370-2317	17 Mile	Entire drainage
16.	221-60-11390	Sewage Lagoon	Entire drainage
17.	221-60-11410	Loop Road 1	Entire drainage
18.	221-60-11420	Loop Road 2	Entire drainage
19.	221-60-11430	Siwash Creek	Entire drainage
20.	221-60-11440	Ess Creek	Lower 1/2 of drainage
21.	221-60-11450	City Limits (Crooked Creek)	Waterfalls downstream through Slough area
22.	221-60-11470	Mineral Creek	Brush (Horsetail) Creek, Blondeau Creek

Table 11 shows salmon counts and trends for the last 10 years. In addition to the four species listed, chinook salmon have been found for the last 2 years. No chinook have been counted previous to 1983, and it is thought that these could be strays from A.D.F.& G. releases in Whittier, is located in western Prince William Sound.

Pink salmon returns have historically been low in even years and high on odd years. However, 1983 and 1984 counts do not reflect the same degree of cyclic change noted in previous years. The 1983 counts were lower than expected (Williams and Potterville, 1984) and 1984 counts were 24 times higher than the parent year pink salmon escapement (1982). This dramatic increase in eastern Valdez Bay pink salmon may be the result of numerous factors including: (1) a mild winter and generally warmer salt water temperatures may have increased juvenile salmon survival; (2) increased pink salmon production from the Valdez Fisheries Development Association Private Non-Profit (PNP) Solomon Gulch Hatchery and; (3) a price dispute between canneries and commercial fishermen which reduced the fishing effort. Chum, sockeye and coho salmon do not reflect the even-odd year cycle because of differing genetic evolution.

Valdez Fisheries Development Association (V.F.D.A.) originally operated a small hatchery on Anadromous Stream #145 under a scientific and educational permit. In 1979 and 1980, they conducted chum salmon egg takes at that facility; since then they have conducted their chum egg takes from the same stream but rear them at the Solomon Gulch Hatchery. Chum salmon from Anadromous Stream #145 are primarily 4-year fish with a low percentage of 3- and 5-year-olds. The 1984 chum salmon counts did not reflect any positive impact from the PNP hatchery.

Coho salmon egg takes have been conducted by V.F.D.A. on Corbin Creek, a tributary to the Robe Lake system, since 1982. Their first egg take ended with a 100% mortality due to overheated water. The 1983 Corbin Creek coho egg take resulted in 143,000 eggs. One hundred five thousand juveniles from those eggs are still being held at Age I+ and will be released in the spring of 1985. Eighteen hundred juvenile coho were held aside for warm water rearing in water supplied by the Solomon Gulch hydro plant (Williams and Potterville, 1982). Heavy metals caused a mortality in excess of 50% of those warm water reared juveniles. Eight hundred Age 0+ juvenile coho with right ventral fin clips were released in May 1984. Those 800 coho averaged 78.5 mm in fork length and average weight was 5 grams.

In 1984, three separate coho egg takes resulted in an estimated 300,000 eggs. As in previous coho egg takes, the eggs were transported to Solomon Gulch Hatchery for rearing. Because of their history of loss with heated water, all 1984 coho eggs are being reared in cold water. There have been no hatchery returns of coho salmon to Valdez Arm to date.

Table 11. Port of Valdez salmon counts, 1974-1984.

	Pink Salmon							
	#11390 Sewage Lagoon	#11370 Lowe River System	#11380 Robe Lake System	#11410 Loop Road I	#11420 Loop Road II	#11430 Siwash	#11450 City Limits	#11470 Mineral Creek System
1975	N/C*	15,387	2,461	5,537	N/C	33,113	1,262	947
1976	N/C	1	0	18	N/C	5	5	8
1977	1,418	1,441	330	18,718	4,101	22,120	2,714	179
1978	0	0	2	66	0	0	10	0
1979	1,657	1,770	1,546	16,246	6,012	29,232	5,512	53
1980	43	4	454	790	3	214	178	0
1981	2,868	6,500	1,557	18,400	10,593	31,045	3,870	418
1982	49	15	382	449	7	729	78	0
1983	490	8,503	270	6,889	4,239	23,323	6,274	781
1984	1,263	10,812**	4,478	4,032	1,717	13,073	6,930	133

	Chum Salmon		Red Salmon		Coho Salmon	
	#11459 City Limits	#11470 Mineral Cr System	#11370 Lowe River System	#11380 Robe Lake System	#11370 Lowe River System	#11380 Robe Lake System
1975	N/C	N/C	2	10	1,506	1,533
1976	1,080	564	1	N/C	1,310	1,049
1977	0	0	N/C	9,188	1,363	1,522
1978	111	68	29	972	1,643	5,091
1979	1,277	126	16	2,216	1,536	3,470
1980	2,186	140	0	993	1,329	5,467
1981	3,000	158	20	229	4,516	3,125
1982	5,622	N/C	46	6,673	2,296	8,573
1983	92	3	4	321	801	2,670
1984	2,139	N/C	132	1,965	642***	3,666

* No count taken.
** Flooding caused large area to be uncountable and also created new sections to be counted.
*** Flooding caused large area to be uncountable.

LITERATURE CITED

Burger, C., M. Scott, M. Small, and W. Potterville. 1983. Overwintering and spawning areas of steelhead trout (*Salmo gairdneri*) in tributaries of the Upper Copper River, Alaska. Final Report. U.S. Fish and Wildlife Service, National Fishery Research Center. 26 pp.

Mills, M.J. 1984. Alaska statewide sport fish harvest studies (1983). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1983-1984, Project F-9-16, 25(SW-I-A): 122 pp.

Scott, W.B. and E.J. Crossman. 1973. Freshwater Fishes of Canada. Fisheries Research Board of Canada, Ottawa. 966 pp.

Williams, F.T. 1969. Inventory and cataloging of the sport fish and sport fish waters of the Copper River, Prince William Sound and the upper Susitna River drainages. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1968-1969, Project F-9-1, 10(14A): 275-289.

_____. 1971. Inventory and cataloging of sport fish and sport fish waters of the Copper River, Prince William Sound and the upper Susitna River drainages. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1970-1971, Project F-9-3, 12(G-I-F): 117-136.

_____. 1975. Inventory and cataloging of sport fish and sport fish waters of the Copper River, Prince William Sound, and the upper Susitna River drainages. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1974-1975, Project F-9-7, 16(G-I-F): 121-144.

Williams, F.T. and W.D. Potterville. 1982. Inventory and cataloging of sport fish and sport fish waters of the Copper River, Prince William Sound, and the upper Susitna River drainages. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1981-1982, Project F-9-14, 23(G-I-F): 65 pp.

_____. 1983. Inventory and cataloging of sport fish and sport fish waters of the Copper River, Prince William Sound and the upper Susitna River drainages. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1982-1983, Project F-9-15, 24(G-I-F): 54 pp.

_____. 1984. Glennallen/Prince William Sound angler use and stock assessment studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1983-1984, Project F-9-16, 25(G-I-F): 86 pp.

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